

classifying, or as it might be phrased of "lexiconising," finger-prints is developed, the more wide will their use become. They ought to be especially valuable in checking desertions from the Army and Navy. But there may be moral objections to the use of finger-prints in these cases for, according to the present system of recruiting, many take refuge in the Army who are "wanted" by the police, and would strongly object to being finger-printed.

A few words should be added concerning the ancient usage of finger-prints in China, Japan, and India for legal purposes. Good evidence as to this has at length been supplied by Minakata Kumagusu in two letters to *NATURE*, vol. li., pp. 199 and 274. It is clear that it was used to some extent, but there is nothing as yet to show that the impressions were made and scrutinised with anything like the precautions now considered to be essential to the good working of the system. Blurred finger-prints cannot be correctly deciphered except by a trained expert, using lenses and photographic magnification. Negative evidence is often of conspicuous value, such as should leave no reasonable doubt in the mind of the most stupid jurymen; but expert analysis and severe cross-examination are required when the prints to be compared are generically alike and when one of them is imperfect or blurred.

F. G.

#### EDUCATION AND PHYSIQUE.

*Mécanisme et Éducation des Mouvements.* By Prof. Georges Demeny. Pp. ii + 523; 565 figures. (Paris: Félix Alcan, 1904.) Price 9 francs.

THERE are few more important or more opportune considerations in connection with practical hygiene than those which are furnished by the subject-matter of the two books written by M. Demeny. The first of these books, a second edition of which appeared in 1903, is entitled "Les Bases scientifiques de l'Éducation physique"; this is now supplemented and given a direct practical bearing by the present work, which sets forth in some detail the technical aspects of the subject. As regards its general character the method of treatment remains distinctly scientific; but since the avowed aim of the author is to set forth the real advantages to be derived from bodily exercises conducted along proper lines, the scope of this later book is eminently educational, and thus it appeals to all those who take a broad view of education and its requirements. This appeal is accentuated by the mode of presentation, which is such as to render the extensive subject-matter intelligible to those who make no pretensions to special physiological knowledge.

It is true that the opening chapter deals of necessity with such physiological questions as the structure and functions of muscle, the mechanism of joints, and the capacity for movement which are allowed by the skeletal articulations; but these and other fundamental points of like nature are treated in a manner which, whilst in strict accord with the present state of scientific knowledge, is of such a character as to render these various topics easy of comprehension.

This introduction leads up to a most interesting analysis of the part played by the muscles in producing various well known body movements. In this stress is laid upon the comparatively modern discovery that any movement, for instance the flexion of a limb, is produced not only by the pulling force of those muscles which move it in the desired sense, the flexors, but also by the relaxation of those which oppose this movement, the extensors. It is this twofold muscular mechanism which permits of the movement being graduated so finely as regards both its extent and its force. Some illustrations of a striking character are given in support of this aspect of a volitional or secondary automatic movement.

For the majority of readers, the great interest of the book will probably lie in the interesting account which it gives of various familiar movements. These are all accompanied by numerous illustrations which are excellent for their purpose, and greatly enhance the attractiveness of the text. Many of these are spirited diagrammatic representations of the skeleton, the form of which in all manner of bodily postures is drawn with that piquancy and verve which constitute to English eyes the special charm of French draughtsmanship; humour cannot be expected in a letterpress which deals with subject-matter so technical and serious, but it is supplied by the illustrations, which give a humorous fillip to the work without detracting in the least from their undoubted service in helping the reader to follow the exposition.

The section which deals with the various forms of locomotion, walking, running, jumping, &c., is perhaps the most elaborate. The author is here on ground which he has studied minutely for many years. As chief of the laboratory at the physiological station in the Collège de France, he is able to set forth with authority the results of the elaborate and prolonged investigations initiated by Prof. Marey and carried on under his inspiring influence. It is probable that the summary of these investigations given by M. Demeny is the most valuable short exposition of this really difficult subject which has been published up to the present time. The lucidity of the author's style and treatment is conspicuous in this portion of the book, for the matter dealt with is not easily set forth in a way which admits of being readily understood, since it involves mathematical considerations which are apt to prove a stumbling block to physiological students.

But, as stated before, the description of the factors concerned in the production of familiar postures of the body and the side-issues which these raise, will for most readers probably prove the most attractive portion of the work. From standing, sitting, and lying down, the author proceeds to carrying loads, vaulting, kicking, throwing, swimming, rowing, cycling, horse-riding, dancing, singing, fencing, boxing, wrestling, and all the various bodily movements which are concerned in the various forms of athletic or industrial exercise. It would be impossible to give any detailed account of his treatment of these subjects, but it may be confidently stated that this treatment, whilst scientifically sound, is rendered

entertaining by the copious illustrations and interesting through the many novel points which are touched upon. As an example of the latter, the question is raised as to the physiological limits of the rapidity of effective response in fencing and boxing, and experiments are cited bearing on this point.

A more serious, and at the present moment more important, aspect of the subject-matter is that which deals with body movements in relation to the improvement of general bodily physique. These are dealt with in the same comprehensive manner as those just referred to, for the author includes most of the gymnastic exercises used in France, Swedish drill, the use of clubs and of apparatus of different kinds.

The malformation of the body is also referred to, whether due to the under-development or to the over-development of special muscular groups; as an example of the first, the malformation of the chest through the weakness of the trunk muscles, abdominal muscles, &c., is conspicuously shown; as an example of over-development, the malformation of the thigh in fencing masters.

The closing chapters are devoted to the conditions which may be presumed to determine how muscular force can be most economically directed towards the production of body movements. The author realises that it would be undesirable in a treatise of a semi-popular character to present this extremely important subject in detail; nor, indeed, can it be set forth in a very convincing manner, since several questions of a fundamental type are still from the scientific point of view in an unsettled state. Thus it is still a matter of doubt how closely the heat-producing properties of muscle are associated with those of mechanical tension or change of form. M. Demy is well aware of this, and warns his readers that it is impossible to deduce the energy relationships of the animal mechanism from those of artificially constructed machines. In this as in other departments of physiology the hope of arriving at a more precise intellectual standpoint is that expressed by one of Bacon's aphorisms; it will "only be well founded when numerous experiments shall be received and collected into natural history which, though of no use in themselves, assist materially in the discovery of causes and axioms."

In this spirit the various experiments detailed in the concluding chapter of the book must be approached. Most of these are concerned with the influence of walking with definite loads for definite distances; the points noted were the number of steps per minute, the length of the stride, and the posture of the body. It appears that when, as in walking, muscular movements are repeated many times, then there is an optimum rhythm which, by permitting appropriate reparation, allows the maximum of effect with least expenditure of muscular power. The author considers this to be the case in almost all body movements, although experiments are not given in support of this generalisation.

The book as a whole is likely to prove of very considerable value in connection with the subject of physical degeneration, which has been for some time

agitating the mind of the public. Methods of education it is now realised should, from the hygienic point of view, concern themselves with the posture of the body. In the code for 1905 issued by the Education Department stress is laid upon the importance of "the careful cultivation of a correct posture at writing and other lessons." This tardy awakening of the authorities to the importance of cultivating the bodily physique of the children who are taught in the national schools renders it probable that teachers will desire to instruct themselves in the fundamental scientific aspects of the various methods for improving the bodily structure and functions. In this respect a work such as that now under review is likely to prove of very real service; it is trustworthy, it approaches the whole question of body posture from a point of view at once scientific and utilitarian, it attacks the fundamental question (that, namely, of the effective action of the muscles), and finally, it is written in a style which makes the subject-matter intelligible without presupposing special technical knowledge on the part of the reader. The only drawback to its utility is one which is susceptible of removal by its translation into English.

F. G.

#### GEOMETRY OF POSITION.

*On the Traversing of Geometrical Figures.* By J. Cook Wilson. Pp. x+154. (Oxford: Clarendon Press, 1905.) Price 6s. net.

SUPPOSE that an outline figure of any kind is drawn upon a blackboard. In its construction the chalk describes a certain number of closed or open paths, a path being defined as the mark made by the chalk during the whole time of any one of its contacts with the board. But the number of paths thus actually described is not necessarily the smallest by which the figure can be produced, and it is an interesting problem to analyse a given figure into its minimum number of paths, each traversed once. As a simple example, let two oval paths be drawn intersecting in four points; the resulting figure can be traversed as one closed path. If two of the intersections are joined, the new figure can be traversed as one open path; if the remaining intersections are joined, the figure cannot be reduced to less than two paths.

The first two parts of Mr. Wilson's book deal with the problem above stated and various associated questions. The most interesting result is one of greater generality than might have been expected. Let a point in the figure be called odd or even according as an odd or even number of lines radiate from it; then a figure with  $2n$  odd points can be analysed into  $n$  paths, but no fewer. (To include the case when  $n=0$  a slightly modified statement is necessary, which will be found in the book.)

In part iii. the author enters upon new ground by applying the principle of duality; this is the most novel part of the book, and a few comments on it may not be superfluous. The results of the first two parts may, of course, be directly reciprocated without introducing any metrical considerations; but this is